Electrical Safety IN THE WORKPLACE

Electrical Safety Compliance & Standards

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Contents

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Changes to NFPA 70E® 2021 for Electrical Safety in the Workplace®

IMPORTANT TO KNOW

Electricity has long been recognized as a serious workplace hazard, for both people who work directly with it – such as electricians and engineers – and others who may work with electricity indirectly. Potential sources of exposure are many: overhead lines, cable harnesses, circuit assemblies and more. In a fraction of an instant, an electrical incident can kill, injure, or disable a worker. Electrical injuries to workers can result from electrocution, shock, burns, or from falls caused by the worker coming into contact with electrical energy. In 2018, 160 workers were killed and 1,560 injured in U.S. workplaces, according to the Electrical Safety Foundation International (ESFI). 1 More than half of the fatal electrical injuries that year occurred in the construction industry.

NFPA 70E, which was originally developed at OSHA's request, is considered the definitive standard for electrical safety in the workplace. It includes information about arc fl ash incident energy, lockout-tagout procedures and personal protective equipment (PPE) that can mitigate the risk of an electrical injury.

STANDARD REQUIREMENTS

Whenever possible, turn off electrical power during the work being done and verify that it stays off until the task is completed. This can be done by: individual qualified employee control; simple lockout/tagout or complex lockout/tagout.

When it is necessary to work "live" near exposed energized parts, a live work permit that describes the work to be performed and why it must be performed should be signed by the customer, engineers or other person in charge.

For shock protection, three shock hazard boundaries should be determined: limited approach, restricted, and prohibited. These boundaries help identify who should be allowed (i.e., only qualified persons can enter the restricted approach boundary) and when workers must use voltage-rated rubber gloves and fiberglass tools.

The flash protection boundary (FPB) must also be determined. Anyone working closer than 48in to live parts must wear PPE to protect against arc fl ash. This may include overalls, jackets, and vests made of material that blocks heat energy and that has non-conducive hardware.

The Hazard/Risk Category (HRC) must be determined, based on tables provided by the standard. Determine Hazard/Risk Category (HRC). The HRC level helps electrical workers select the correct type of PPE to wear, based upon the task they are performing live.

Workers must wear appropriate PPE whenever they are performing tasks within the FPB, whether or not they are actually touching the live equipment.

A LOOK AT THE REVISIONS

Home of the 2021 revisions have been reorganizing. For instance, Article 110 of the standard – General Requirements for Electrical Safety-Related Work Practices — has been revised to consolidate general requirements for electrical safety-related work programs, practices and procedures from other articles. The first priority in implementing these work practices is hazard elimination. Energized electrical conductors and circuit parts operating at voltages equal to or greater than 50 volts are to be put into an electrically safe condition before an employee performs work if the individual is within the limited approach boundary and/or the individual interacts with equipment where conductors or circuit parts are not exposed but an increased likelihood of injury from an exposure to an arc flash hazard exists.

"Protecting workers is what inspires GlenGuard every day to engineer comfortable and durable performance AR/FR fabrics for workwear. Although it's a voluntary standard, all of our GlenGuard fabrics meet NFPA 70E requirements because GlenGuard believes that NFPA 70E is critical in the avoidance of unnecessary workplace injuries and fatalities."

Electrical safety training for employees exposed to specific hazards associated with electrical energy is to be classroom-based, on-the-job, or a combination of the two. New to the 2021 edition: classroom training can include interactive electronic or interactive web-based training components. The 2021 70E® edition places a new emphasis on keeping on fi le, documenting, and following the recommendations of electrical equipment and PPE manufacturers' instructions. Manufacturers' instructions sometimes have been skipped because the information might be hard to access, forcing workers to dig through equipment packaging, or small print instructions have made readability difficult. Manufacturers must now make instructions and recommendations more readable and more accessible.

Personal protective equipment (PPE) constitutes part of NFPA 70E®. PPE includes nonconductive head protection, eye protection, hearing protection, and arc-rated clothing whenever there is possible exposure to an electric arc fl ash, insulating blankets, and non-melting footwear. The 2021 edition addresses the common practice of wearing high-visibility vests over arc rated clothing. In the past qualified workers that were required to wear high-visibility vests had to remove the vests if the vest did not meet the level of arc fl ash protection required.

Now qualified workers can wear a category 1 arc rated high-visibility vests (4 cal/cm2) during the workday and not have to remove it to perform electrical troubleshooting or voltage measurements. Acceptable electrical safety footwear has been expanded in the 2021 edition to go beyond traditional leather footwear to include other types footwear other than leather or dielectric as long as it has been tested to demonstrate no ignition, melting, or dripping at the estimated incident energy exposure or the minimum arc rating for the respective arc fl ash PPE category.

In addition, the definition of balaclava has been changed. The word "hood" and "sock" were removed. The new definition: an arc-rated head-protective fabric that protects the neck and head except for a small portion of the facial area.

INCREASE YOUR KNOWLEDGE

The complete standard is available online at: https://webstore.ansi.org.

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Our new YouTube Channel, THE FRONTLINES, is designed to keep you informed on issues relating to AR/FR PPE safety compliance»

THE FRONTLINES

youtube.com/GlenGuard

The OSHA standard for The Control of Hazardous Energy (Lockout/Tagout)

Title 29 Code of Federal Regulations (CFR) Part 1910.147

IMPORTANT TO KNOW:

If your employees service or maintain machines, where the unexpected startup, energization, or the release of stored energy could cause injury, then OSHA's Control of Hazardous Energy (Lockout/Tagout) Standards should be at the forefront of your safety protocols and procedures.

According to OSHA, employees servicing or maintaining machines or equipment may be exposed to serious physical harm or death if hazardous energy is not properly controlled. Craft workers, machine operators, and laborers are among the 3 million workers who service equipment and face the greatest risk. Compliance with the lockout/tagout (LOTO) standard prevents an estimated 120 fatalities and 50,000 injuries each year. Workers injured on the job from exposure to hazardous energy lose an average of 24 workdays for recuperation.

The LOTO standard establishes the employer's responsibility to protect employees from hazardous energy sources on machines and equipment during service and maintenance. The standard gives each employer the flexibility to develop an energy control program suited to the needs of the particular workplace and the types of machines and equipment being maintained or serviced. This is generally done by affixing the appropriate lockout or tagout devices to energy-isolating devices and by deenergizing machines and equipment. Remember, employees need to be trained to ensure that they know, understand, and follow the applicable provisions of the hazardous energy control procedures.

THE STANDARDS ESTABLISH REQUIREMENTS THAT EMPLOYERS MUST FOLLOW AND OUTLINED BELOW ARE THE MOST CRITICAL:

- Develop, implement, and enforce an energy control program.
- Use lockout devices for equipment that can be locked out. Tagout devices may be used in lieu of lockout devices only if the tagout program provides employee protection equivalent to that provided through a lockout program.
- Ensure that new or overhauled equipment is capable of being locked out.
- Develop, implement, and enforce an effective tagout program if machines or equipment are not capable of being locked out.
- Develop, document, implement, and enforce energy control procedures. [See the note to 29 CFR 1910.147(c)(4)(i) for an exception to the documentation requirements.]
- Use only lockout/tagout devices authorized for the particular equipment or machinery and ensure that they are durable, standardized, and substantial.
- Ensure that lockout/tagout devices identify the individual users.
- Establish a policy that permits only the employee who applied a lockout/tagout device to remove it. [See 29 CFR 1910.147(e)(3) for exception.]
- Inspect energy control procedures at least annually.
- Provide effective training as mandated for all employees covered by the standard.
- Comply with the additional energy control provisions in OSHA standards when machines or equipment must be tested or repositioned, when outside contractors work at the site, in group lockout situations, and during shift or personnel changes.

INCREASE YOUR KNOWLEDGE:

Visit OSHA's eTool for an interactive training program that will expand your knowledge of the LOTO standard. Additionally, OSHA has various publications, standards, technical assistance, and compliance tools to help you. These are available at www.osha.gov.

Update: Changes to NFPA 70E® 2021 Edition

What You Need to Know to Stay Current

By Steve Edwards & Jay Smith, Contributors

The National Fire Protection Association's 2021 (NFPA) 70E® Standard for Electrical Safety in the Workplace® has been updated and is now in effect. NFPA 70E® is one of the most widely used consensus standards in U.S. workplaces. The standard has a comprehensive scope (the 2021 standard is 100+ pages), addressing electrical safety-related work practices, safety-related maintenance requirements, and administrative controls to protect employees from electrical shock and arc flash. The standard covers every part of electrical work from voltage measuring and troubleshooting on both ac and dc systems, de-energizing equipment, and verifying the absence of voltage before any work is done.

NFPA70E standard is revised every three years. The 2021 edition of NFPA 70E® was issued on June 1, 2020 and became effective June 21, 2020. The changes are important for every electrical worker to understand so they can keep in compliance and stay safe on their jobs.

A LOOK AT THE REVISIONS:

- Some of the 2021 revisions have been reorganizing. For instance, Article 110 of the standard – General Requirements for Electrical Safety-Related Work Practices — has been revised to consolidate general requirements for electrical safety-related work programs, practices and procedures from other articles. The first priority in implementing these work practices is hazard elimination. Energized electrical conductors and circuit parts operating at voltages equal to or greater than 50 volts are to be put into an electrically safe condition before an employee performs work if the individual is within the limited approach boundary and/or the individual interacts with equipment where conductors or circuit parts are not exposed but an increased likelihood of injury from an exposure to an arc flash hazard exists.

- Electrical safety training for employees exposed to specific hazards associated with electrical energy is to be classroom-based, on-the-job, or a combination of the two. New to the 2021 edition: classroom training can include interactive electronic or interactive web-based training components.

- The 2021 70E® edition places a new emphasis on keeping on file, documenting, and following the recommendations of electrical equipment and PPE manufacturers' instructions. Manufacturers' instructions sometimes have been skipped because the information might be hard to access, forcing workers to dig through equipment packaging, or small print instructions have made readability difficult. Manufacturers must now make instructions and recommendations more readable and more accessible.

- Personal protective equipment (PPE) constitutes part of NFPA 70E®. PPE includes nonconductive head protection, eye protection, hearing protection, and arc-rated clothing whenever there is possible exposure to an electric arc flash, insulating blankets, and non-melting footwear. The 2021 edition addresses the common practice of wearing high-visibility

vests over arc rated clothing. In the past qualified workers that were required to wear high-visibility vests had to remove the vests if the vest did not meet the level of arc flash protection required. Now qualified workers can wear a category 1 arc rated high-visibility vests (4 cal/cm2) during the workday and not have to remove it to perform electrical troubleshooting or voltage measurements

- Acceptable electrical safety footwear has been expanded in the 2021 edition to go beyond traditional leather footwear to include other types footwear other than leather or dielectric as long as it has been tested to demonstrate no ignition, melting, or dripping at the estimated incident energy exposure or the minimum arc rating for the respective arc flash PPE category.

- In addition, the definition of balaclava has been changed. The word "hood" and "sock" were removed. The new definition: an arc-rated head-protective fabric that protects the neck and head except for a small portion of the facial area.

CIRCUIT BREAKER SAFETY AND BATTERY SAFETY

Circuit breaker safety and battery safety have new requirements in the 2021 edition. When circuit breakers are initially switched on after installation or after maintenance has been completed, operators are now required to wear appropriate arc-rated PPE. This change affects potentially every maintenance employee in a workplace.

Also, circuit breakers that interrupt faults approaching their interrupting ratings are to be inspected and tested according to the manufacturer's instructions.

The ever-increasing power of batteries (in particular lithium batteries) is addressed in the 2021 edition. Energy exposure levels are not to exceed 50 volts AC and 5 milliamperes and 100 volts DC unless proper controls are implemented. Multiple hazards may be encountered when working on batteries, such as shock, arc flash, chemical, and thermal. PPE selection should consider all the hazards, depending on the task.

Typically, in the past, lithium batteries came in cells of 1.5 volts for uses such as powering cordless drills or cordless lawn mowers. More recently, lithium batteries come in packs of cells where voltage can exceed 100 volts. Some systems use lithium batteries with up to 1,000 volts. This is the type of power needed for electric automobiles, buses, and trucks. This level of energy can create serious electrical shock and arc flash hazards for employees. Heat released during cell failure can damage nearby cells, releasing more heat in a chain reaction known as a thermal runaway. The high-energy density in lithium batteries makes them more susceptible to these reactions.

The NFPA 70E® 2021 requires an arc flash risk assessment be conducted prior to any work on a battery system over 100 volts to identify chemical, electrical shock, arc flash hazards, and requires an assessment of the risks associated with the type of task being performed. Lower voltage can result in a bodily shock caused by a spark. Newer, higher industrial voltages can cause an arc flash explosion, necessitating the risk assessment.

A new article (Article 360) was added that covers safety related work requirements when working with capacitors. The article covers specific personal safety measures that must be completed by workers when working with or de-energizing capacitors.

The next edition of NFPA 70E® is set for the year 2024. The first draft public input deadline will be June 1, 2021, with the first draft being posted March 22, 2022. The second draft will be posted February 28, 2023.

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Setting The Record Straight: Equipment Safety in Hazardous Areas

By Robert Potter & Richard Holub, Contributors

When it comes to using equipment in hazardous location classified areas that's manufactured in other countries, what are the rules? What certifications are necessary? And how do you tell if equipment is safe for your application?

Hazardous location classified areas contain flammable gas, liquids or vapors, combustible dusts, or easily ignitable fiber and flyings. When one of these are combined with an oxidizer and ignition source, the result may be an explosion or fire.

In North America, equipment meeting relevant hazardous area location certifications first must meet ordinary location requirements. These "ordinary" standards include but are not limited to:

- UL 94-VO standard for flammability
- UL 489 for molded case circuit breakers
- UL 50 and NEMA 250 standards for electrical enclosures, and
- UL 1581 standard for electrical wires, cables and flexible cords.

In our view, there is a common shortfall with hazardous areas solutions from overseas; they may not be tested to the general ordinary location American standards for suitability. In contrast, North American products applied in hazardous locations classified areas must first meet the requirements of ordinary locations before approval for hazardous areas may be achieved.

When organizations decide to use technology from outside of North America, there are the National Electrical Code (NEC) and Occupational Safety and Health Administration (OSHA) exceptions to consider. It's essential to understand there is tremendous liability to use those technologies if equipment is not certified to North American standards.

PRIMER ON ZONE EQUIPMENT CERTIFICATION

The Zone method has become a worldwide accepted practice for classifying hazardous location classified areas. The International Electrotechnical Commission System for certification to standards relating to equipment for use in explosive atmospheres (IECEx System) lists 62 countries that are full members and an additional 26 as associate members. Many countries have their own directives and certification requirements for equipment approvals within their borders.

The Zone method dates back to 1996 and was first introduced by the NEC, National Fire Protection Association (NFPA) with Article 505. It allows for parallel classification in the traditional NEC Article 500 Division system.

In this division system, Zone terminology was used as the international system for classification of hazardous locations containing flammable gasses, liquids or vapors, combustible dust, or ignitable flyings, which divided classified areas into three segments: Zone 0, Zone 1, or Zone 2 for gases/ vapors, and Zone 20, Zone 21, Zone 22, for combustible dust and ignitable flyings.

Today, Zone-rated equipment still requires certification of ordinary location requirements in the U.S. The AEx marking, developed by the American National Standards Institute (ANSI) and International Society of Automation (ISA), ensures that Zone equipment conforms with hazardous location requirements *and* the general ordinary location American safety standards. As such, the AEx symbol is a critical marking requirement within the Zone material nomenclature.

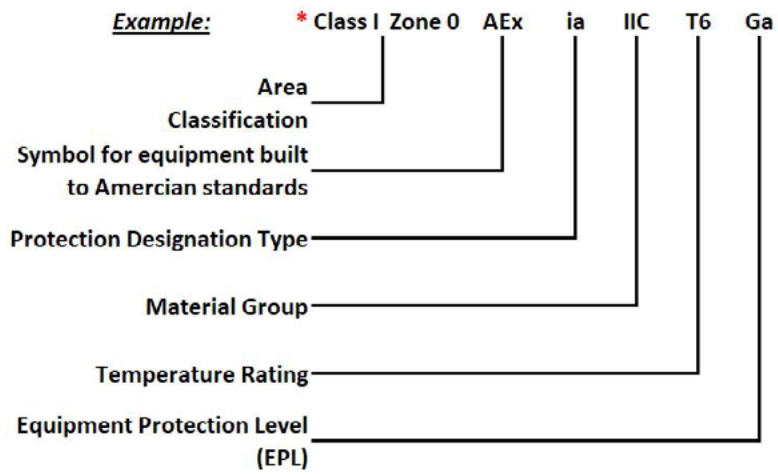
The AEx marking per NEC article 505.9 and Article 506.9 certifies the equipment has been produced to American standards—conforming with both general standards for ordinary locations and hazardous area requirements.

The Authority Having Jurisdiction (AHJ) and qualified testing labs have an essential role. The AHJ can approve equipment when there is sufficient safety data. Further, if equipment is listed by a qualified lab, then the internals of the equipment do not need to be inspected, except to look for problems, changes, or damage.

Note: The 2020 Edition of the National Electrical Code allows for the Class I marketing to be optional

What if an AEx-Zone or Division certified technology isn't available?

The NEC Article 500.8(A) addresses this possibility and indicates that the suitability of equipment is determined by one of the following:



Example of Zone Method Equipment Marking

* The 2020 Edition of the National Electrical Code allows for the Class I marking to be option

- equipment listing
- evidence of equipment evaluation from a qualified testing lab or AHJ, or
- evidence acceptable to the AHJ like a manufacturer's self-evaluation or owner's engineering judgement

In our view, a manufacturer's self-certification and owner's engineering judgement must be carefully reviewed and *only* be considered when the decision maker is fully confident that ordinary safety standards have been achieved. This evidence must also be accepted by the AHJ.

Further, OSHA provides additional guidance and requirements for product allowance. OSHA 29 CFR 1910.399 defines equipment acceptable for hazardous environments if it is:

1. Determined safe by a nationally recognized testing lab
2. Inspected by another federal agency, or by a state, municipal or other local authority responsible for enforcing occupational safety provisions of the NEC and found in compliance with the NEC
3. Determined to be safe (for it's intended use) by the manufacturer, based on test data, that the employer keeps and can provide for inspection purposes.

ZONE METHOD RATED EQUIPMENT: MARKED WITH AEX, LISTED BY A NATIONALLY RECOGNIZED TESTING LAB

The OSHA and NEC allowances permit for a product to be approved for installation without third-party testing by a nationally recognized testing lab (NRTL); OSHA lists 19 NRTLs on their website, including UL, CSA, ETL-Intertek, and FM.

However and importantly, both the OSHA and NEC language indicate the general rule is that equipment *should be tested and listed by a NRTL—unless these avenues have been exhausted.*

When thinking about electrical equipment without testing by a NRTL, it's important to consider:

- Does the state or municipality where equipment is being installed have requirements only allowing for the installation of third-party evaluated equipment?
- Does the customer facility have requirements only allowing for installation of third-party NRTL evaluated equipment?
- Who is shouldering the liability for the owner's engineering judgement or self-evaluated equipment for suitability of ordinary and hazardous-area locations?

Facilities using the NEC Articles 505 and 506 Zone classification of hazardous location classified areas are governed by the approval requirements outlined in the NEC articles for the wiring methods and equipment certification.

When zone method-rated equipment includes the AEx marking, it means the equipment is certified to the American standards per NEC Article 505.9 (C) and Article 506.9 (C). That AEx marking ensures the Zone equipment conforms with both hazardous location requirements and general safety American standards for ordinary locations. These certifications give customers confidence and trust in the equipment they're applying. ESW

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Dealing with ANSI Z359 Standards Doesn't Have to Be Confusing

"Falls are among the most common causes of work-related injuries and death," says the U.S. government's Occupational Safety and Health Administration (OSHA).

Fortunately, fall arrest devices and worker safety protection programs are in place to help keep workers from harm.

One of the best protectors? Fall protection systems, which date back to the early 20th century when Rose Mfg. Co., owned by MSA The Safety Company since 1996, pioneered the manufacture and use of safety belts and lanyards.

Later, the company developed modern-day shock absorption, including what OSHA recognized as a "major innovation" in fall arrests – the full-body harness.

In addition to advances in fall protection gear through manufacturers like MSA, the American National Standards Institute (ANSI) voluntarily established fall arrest protection standards in the 1990s.

THE STANDARD

First published in 1992 as ANSI Z359.1, reaffirmed in 1999, and revised in 2007, the ANSI Z359.1 standard established requirements for "performance, design, marking, qualification, instruction, training, inspection, use, maintenance and removal from service" for non-construction occupation fall arrest systems including:

- Full-body harnesses
- Lanyards
- Connectors
- Energy absorbers
- Fall arresters
- Vertical lifelines
- Anchorage connectors

In short, ANSI Z359.1 used to be an all-encompassing product standard.

LABELING

In 2007, ANSI subcommittees embarked on a fundamental overhaul of the Z359.1 standard, detailing requirements by component instead of creating what could be essentially thought of as a "lump-sum" requirement.

In the 10 years since, ANSI Z359 has been completely revamped, creating individual standards from .2 through .18. Some ANSI Z359 standards are specific to products, others are procedural or managerial, yet all are designed for the safety and protection of the worker at height.

"If your company isn't completely clear on the design, testing, and approval requirements for fall protection gear manufactured and sold as compliant with ANSI Z359 requirements," says Rob Senko, MSA's Industrial Segment Market Manager, "you could be making the wrong product selection or, worse, putting your workers at risk."

TESTING

When it comes to fall protection, safety and program managers must find the best gear for the job and the worker.

More importantly, they need to make sure that gear is compliant with testing requirements and labeled to the latest ANSI requirements.

But with ever-changing OSHA requirements, a decade of ANSI changes, and plenty of blah-blah-gobbledygook-speak designed to cast doubt or discredit some testing and compliance programs, it can be downright baffling to keep up.

Here, Senko helps clear up the confusion:

1. The .1 standard will now become the guidance document.
2. As of Feb. 16, 2018, all new fall protection products manufactured shall be labeled to their respective standard.
3. Already-in-service equipment labeled to the .1 standard can be used until it is removed from service.
4. Steer clear of new products (other than anchorage connectors) labeled to the ANSI Z359.1 standard.
5. Purchase PPE products from a PPE manufacturer with a demonstrated testing and compliance program.

"Remember that ANSI is a voluntary standard, yet when combined with a robust safety program, and innovative fall protection products tested in an ISO-accredited lab like ours," says Senko, "you're doing the right things to help keep your workers safe at height."

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